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ABSTRACT

This paper is a master's thesis reporting research on the effects of two instructional variables, recall of relevant subconcepts and information regarding the attributes of the concept instances on immediate concept learning, transfer and retention. Three sets of instructions were written varying in the amount and type of information given. These instructions preceded five lessons dealing with geometric concepts. The subjects were 102 sixth-graders who were randomly assigned to one of five experimental groups which were defined by the content of the materials they received. Concepts were presented in a narrative style which was intended to be interesting to the students. After completion of the lessons, the students were given a test to measure initial acquisition of the concepts and transfer. Eighteen days later the same test was given to measure retention and delayed transfer. Data indicated that recall of relevant subconcepts did not have a significant effect on the specific immediate test, on the specific retention test, and on the immediate transfer test. There was a significant effect on the delayed transfer test. (FL)

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Working Paper No. 45

The Effects of Information Concerning the Attributes of Concept Instances and Recall of Relevant Subconcepts on the Level of Mastery of Certain Geometric Concepts

Report from the Project on Situational Variables and Efficiency of Concept Learning

Wisconsin Research and Development
CENTER FOR COGNITIVE LEARNING

THE UNIVERSITY OF WISCONSIN
Madison, Wisconsin

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THE EFFECTS OF INFORMATION CONCERNING THE ATTRIBUTES OF CONCEPT INSTANCES AND RECALL OF RELEVANT SUBCONCEPTS ON THE LEVEL OF MASTERY OF CERTAIN GEOMETRIC CONCEPTS

by

Barbara Jones Marten

Report from the Project on
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STATEMENT OF FOCUS

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Working Paper is from the Situational Variables and Efficiency of Concept Learning Project in Program 1. General objectives of the Program are to generate new knowledge about concept learning and cognitive skills, to synthesize existing knowledge, and to develop educational materials suggested by the prior activities. Contributing to these Program objectives, the Concept Learning Project has the following five objectives: to identify the conditions that facilitate concept learning in the school setting and to describe their management, to develop and validate a schema for evaluating the student's level of concept understanding, to develop and validate a model of cognitive processes in concept learning, to generate knowledge concerning the semantic components of concept learning, and to identify conditions associated with motivation for school learning and to describe their management.

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ABSTRACT

The objective of this study was to determine the effect of instructions acquainting the students with the attributes of the concept examples and instructions providing the recall of relevant subconcepts on the level of concept mastery.

Three sets of instructions were written, varying in the amount and type of information given. The informational content was as follows: (1) attribute information, (2) recall of relevant subconcepts, and (3) attribute information and recall of relevant subconcepts. These sets of instructions preceded five lessons dealing with geometric concepts. A control group studied lessons unrelated to geometry. The subjects, 102 sixth-grade children, studied these lessons for five days.

After completion of the fifth lesson, children were given a multiple-choice test to measure initial acquisition of the concepts and transfer. Eighteen days later, the same multiple-choice test was given to measure the retention of the concepts and delayed transfer.

The essential findings of the study were:

(1) Providing for the recall of relevant subconcepts did not have a significant effect on immediate concept mastery or on retention.

(2) Providing for the recall of relevant subconcepts did not have a significant effect on immediate transfer but did on delayed transfer.

(3) Acquainting Ss with the attributes of the concept examples did not significantly affect immediate concept mastery or retention.

(4) Acquainting Ss with the attributes of the concept examples did not significantly affect immediate transfer or delayed transfer.

(5) Providing lessons dealing with the geometric concepts significantly increased immediate concept mastery and retention.

(6) Providing lessons dealing with the geometric concepts did not significantly increase immediate transfer, but did significantly increase delayed transfer.

Chapter I

INTRODUCTION

In 1956, after the Russian space shot, American educators became concerned with the science and mathematics curricula in American public schools. New curriculum materials were written to meet the demands for more substantive materials in these areas. However, during this period of redirection, little classroom research was carried out on specific variables that might facilitate the learning of science and mathematic concepts.

Many studies on concept learning have been conducted in the psychological laboratory. These studies indicate that a wide range of variables influence concept learning. Laboratory research and classroom research may differ in the nature of concepts presented, the method of presentation, the age of the subjects, and the type of dependent measure. However, it is probable that many of the variables found to facilitate performance in the laboratory may also have a positive effect upon the learning of subject matter concepts.

Recently, educational psychologists have focused their attention on extending concept learning research into the real world of the elementary classroom. Leadership in this effort is centered at

the Wisconsin Research and Development Center for Cognitive Learning. Programmatic research and development is underway to identify the features that may be incorporated in printed material to facilitate concept learning by school children.

The present experiment was carried out as a part of this research program. The purpose of this study was to ascertain the effects of introductory instructions on concept learning from textual material. The instructions were intended (a) to acquaint students with the attributes of the concept instances, and (b) to provide recall of relevant subconcepts.

Bruner, Goodnow, and Austin (1956) viewed concept attainment as ". . . the process of finding predictive defining attributes that distinguish exemplars from nonexemplars of the class one seeks to discriminate" (p. 22). The isolation of defining attributes was seen as an essential part of concept attainment. Instructions which help the subject to differentiate stimulus dimensions would be expected to speed the isolation of defining attributes and thereby increase the rate of concept learning. This prediction was confirmed by several laboratory studies (Marks & Ramond, 1951; Pishkin, 1965; and Klausmeier & Meinke, 1968) in which subjects who were given information about the stimulus dimensions, or attributes, of concept instances performed better than subjects who were not given this information.

Two other studies (Holstein & Premack, 1965; Tagatz, 1963) found that stimulus-acquainting instructions did not facilitate

performance on concept-attainment tasks. The lack of effect due to instructions which was noted in these studies, however, might be attributed to the interference of misinformative feedback (Holstein & Premack, 1965) or to the inefficiency of instructions describing relationships between categories of instances (Tagatz, 1963).

One may conclude from the results of these laboratory studies that knowledge of stimulus dimensions does facilitate concept learning depending upon the specific relationship between the information presented and the concept learning task.

Another instructional variable, providing a set to recall relevant subconcepts, has also been investigated. Gagné (1965) described two kinds of recall instructions, differing in purpose. One kind is designed to stimulate the recall of previously learned concepts while the other kind is designed to reinstate the previously learned concept.

Ausubel (1968) discussed two types of review, early and delayed. Early review provides feedback, relearning or initial learning of points missed on the first encounter, and consolidation. In delayed review the learner is more fully aware of what he does not remember and understand. Consequently, he is highly motivated to profit from review. The advantages of early and delayed review are complementary and thus can be effective in combination.

The only study specifically investigating the effect of instructions to recall relevant subconcepts (Namikas & Harris, 1968) found that relevant training combined with instructions to use that training resulted in improved learning.

The lack of research on the effects of instructions to recall relevant subconcepts prohibits firm conclusions, although the existing literature suggests that it may be facilitative.

Purposes and Hypotheses of the Study

The objective of this study was to determine the effects of two variables on the learning of geometric concepts. The two variables were: (1) presence or absence of instructions incorporating information about the attributes of the concepts, and (2) presence or absence of instructions incorporating exercises that required the recall of relevant subconcepts.

Two hypotheses were tested. The first was that instructions providing information about the attributes of the concept would facilitate concept learning. The second was that instructions which explicitly provided for the recall of relevant subconcepts would facilitate concept learning.

Method

Subjects were 102 sixth-grade children. Three sets of instructions were written, varying in the amount and type of information given. The informational content of each of the three sets of

instructions was as follows: (1) information about the attributes of the concept instances, (2) exercises that required the recall of relevant subconcepts, and (3) information about the attributes of the concept instances and exercises that required the recall of relevant subconcepts. Lessons dealing with geometric concepts and lessons dealing with material unrelated to geometry were also written. Children were randomly assigned to one of five experimental groups which were defined by the content of the materials which they received: (1) information about the attributes and geometry lessons, (2) recall of relevant subconcepts and geometry lessons, (3) information about the attributes, recall of relevant subconcepts, and geometry lessons, (4) geometry lessons, and (5) unrelated lessons. Each subject received five lessons. Subjects within a treatment group received the same combination of materials for each of the five lessons.

After completion of the fifth lesson, all children were given a multiple-choice test to measure initial acquisition of the concepts and transfer. Eighteen days later, the same multiple-choice test was given to measure the retention of the concepts and delayed transfer.

Significance of the Study

Textbooks used in the elementary schools have been written, for the most part, on an intuitive basis. Only recently has research been focused upon developing guidelines for effective communication of concepts to children.

If the variables examined in this study prove to be effective, guidelines for utilizing attribute and recall instructions to improve students' concept learning from textual material might be developed.

Chapter II

REVIEW OF RELATED LITERATURE

Results of laboratory studies indicate that introductory instructions can facilitate concept learning. But to clarify the effects of instructions on concept learning, the different roles played by instructions must be identified. Klausmeier and Meinke (1968) defined six purposes which instructions may serve: (a) to acquaint the subject with the stimulus materials; (b) to acquaint the subject with the response desired; (c) to present the subject with information of a procedural type, such as a strategy or method to apply to the solution of the task; (d) to provide the subject with substantive information; (e) to provide a set to recall relevant information; and (f) to manipulate the level of the subject's motivation.

The purpose of this study was to ascertain the effects of introductory instructions intended to accomplish two of the purposes outlined above. These are: (1) to acquaint the subject with the stimulus material, and (2) to provide a set to recall relevant information.

Instructions Concerning Stimulus Material

An early study conducted by Marks and Ramond (1951) compared performance on a card-sorting task for subjects given two different sets of instructions. The instructions established either a "real-life" situation or a "textbook" situation. Subjects in the "real-life" group were instructed to sort the cards into exclusive and consistent categories. The instructions for the "textbook" group included: (a) the information given the "real-life" group, (b) information which indicated that the task was one of helping a fictitious person, and (c) a description of the cards to be sorted in terms of their dimensions.

The percentage of solutions for the "textbook" group was significantly higher than that for the "real-life" group. Marks and Ramond attributed this effect to the impersonal nature of the "textbook" situation. It is plausible, however, that the description of the stimulus materials may have actually been the factor which improved performance.

Klausmeier and Meinke (1968) found that instructions about the structure of the stimulus material improved concept learning. They compared the performance of three groups of college-age subjects who received instructions varying in purpose and amount of information. The "minimal" group received instructions giving minimal information. This information included a slip of paper listing the seven attributes on which the stimuli varied. The "structure"

group received (a) the minimal instructions and (b) information concerning the structure of the stimulus materials. Subjects in the "structure" group were asked to pick a concept instance and point out the seven attributes which it exhibited. The "strategy" group received (a) the minimal instructions, (b) the structure instructions, and (c) a description of a conservative focusing strategy. All subjects were presented with the task of attaining four conjunctive geometric concepts, each having three relevant dimensions.

With time to criterion as the dependent variable, a significant effect due to instructions was observed. The difference between the group receiving minimal instructions and the group receiving structure instructions was not significant. It should be noted, however, that subjects in both the minimal and structure groups received information concerning the seven attributes on which the stimuli varied, which may account for the weak effect of the structure instructions.

Pishkin (1965) tested the possibility that specification of the dimensions of concept instances may facilitate concept learning by reducing the set of hypotheses to be considered by the subject. He developed a two-phase concept identification task manipulating the availability or unavailability of pattern dimensions. In Phase I, subjects received either correct feedback or misinformative feedback. In Phase II, all subjects were given a new

concept learning problem containing one relevant dimension and either one, three, or five irrelevant dimensions. Half of these subjects were assigned to a dimensions available (DA) condition, and the other half to a dimensions not available (DNA) condition. Subjects in the DA condition were given eight slips of paper on which were listed the stimulus dimensions and were told that one of these dimensions would help them solve the problem. Subjects were allowed to refer to the slips at any time during Phase II. Subjects in the DNA condition were simply told that they were to begin a new problem.

The number of errors to solution was significantly lower for subjects in the DA condition. The DA condition had a greater facilitating effect for subjects who received misinformative feedback during Phase I and for subjects having a problem with five irrelevant dimensions. Pishkin suggested that specification of stimulus dimensions reduced the set of hypotheses to be tested and stressed the importance of instructions as a mode of communicating information to subjects.

Holstein and Premack (1965) and Tagatz (1963), on the other hand, found that stimulus-acquainting instructions did not facilitate performance on their concept attainment tasks. Holstein and Premack (1965), in a study similar to Pishkin's experiment, compared "vague" instructions, which did not acquaint subjects with stimulus material, and "explicit" instructions, which did acquaint subjects with stimulus materiai. Unlike Pishkin,

Holstein and Premack found no significant differences due to instructions. However, the procedures utilized in the two experiments differed somewhat. Holstein and Premack's instructions concerning stimulus material were given to subjects before the misinformative feedback rather than after, as was the case in Pishkin's study. Also, there was no signal when the new concept problem was to begin. The lack of effect due to instructions may have resulted from the intervening misinformative feedback.

Tagatz (1963) reported that structure instructions had an inhibitory effect on performance. In this case, however, the structure instructions used did not acquaint the subject with the dimensions of the stimuli. Instead, the information given consisted of a set of seven rules which could be used to determine the relationship between categories of instances displayed on a stimulus board.

The general instructions, given to all subjects, contained information about the nature of the task and the dimensions on which the stimulus material varied. Half of the subjects were also given seven rules relating concept membership of instances to position on the board. The task was to attain two concepts having three and four relevant dimensions from presented information. Time to criterion was significantly longer for those who had received the structural rules. It should be noted that the positional information gained from the rules was not necessary for

solving the problem, since dimensional information was contained in the presented instances. Thus, the rules were inefficient, perhaps accounting for the longer time to criterion.

These laboratory studies indicate that instructions concerning stimulus dimensions facilitates concept learning except when misinformative feedback intervenes between the instructions and the task.

Instructions to Recall Relevant Information

Providing a set to recall essential subconcepts is another way in which directions may facilitate concept learning. Gagné (1965) described two kinds of recall instructions. If the information to be recalled is relatively simple, then instructions which merely stimulate recognition of what was previously learned are sufficient. But when the information to be recalled is more complex and is essential for the new concept to be introduced, the instructions should require reinstatement of the previously learned concept. Gagné emphasized that verbal directions to recall essential information are an important part of the total instructional process.

Ausubel (1968) discussed the effects of early and delayed review. Early review provides the learner with an opportunity to acquire meanings that he partially or completely missed on the first trial, to consolidate meanings initially established at that time, to provide feedback, and to test the correctness of the

knowledge he retained from the first trial. The principal advantage of delayed review is the opportunity to relearn the forgotten material. The learner is more aware of what he has forgotten or does not understand and, therefore, is highly motivated to profit from the opportunity to review.

Only one study has investigated the effect of this variable. Namikas and Harris (1968) trained subjects prior to a concept identification task to sort cards into four categories. For different groups of subjects, the words on these cards were relevant, irrelevant, or neutral with regard to the concept identification task. The subjects were then told that the sorting task either was or was not related to the concept identification task. These instructions did not reinstate the previously learned concept, but stimulated the recall of the formerly learned concept. Namikas and Harris found a highly significant interaction between type of training (relevant, irrelevant, or neutral) and instructions. Subjects who were told that the two tasks were related performed significantly better when they had had relevant training, significantly worse when they had had irrelevant training. Subjects who were told that the two tasks were not related did not differ as a function of the type of past training.

The recall instructions employed in the present study, unlike those employed by Namikas and Harris, sought to reinstate rather than simply stimulate recall of a previously learned concept.

The lack of research on the effect of instructions providing a set to recall essential subconcepts does not allow conclusions to be drawn. Further research is needed to clarify its effect.

Chapter III

METHOD

The purpose of this experiment was to investigate the effects of information concerning the attributes of the concept instances and recall of relevant subconcepts on attainment of behavioral objectives related to concept mastery. On the basis of related research and logical analysis, two predictions were made regarding the effect of these instructional variables: (1) information concerning the attributes of the concept examples would facilitate concept learning, retention, and transfer, and (2) information recalling relevant subconcepts would facilitate concept learning, retention, and transfer.

A secondary purpose of the experiment was to determine what percentage of students would recall the meaning of mediators provided to aid in the recall of concept names and to relate recall of the mediator to concept mastery.

Subjects

The subjects in this study were 102 sixth-grade children. These sixth graders constituted the entire sixth-grade population of Baraboo, Wisconsin. The children were in five classrooms, each of which was hetergeneous with regard to ability. Children were randomly assigned within each classroom to the five treatment groups.

The study began with 120 sixth-grade children. Eighteen students were lost due to absences during the experiment.

Instructional Materials

The concepts were presented in a narrative style which was intended to be interesting to sixth-grade children. Since the lesson booklets were to be read individually by each student, an attempt was made to minimize reading difficulty. Questions concerning the concepts and the answers to these questions were incorporated into this story. Each concept was presented with ten positive examples and six negative examples.

A separate booklet was prepared for each lesson. The lessons were designed to be administered on five successive school days. Geometry lessons were the same for all experimental groups. Variations in the instructions preceding each lesson constituted the experimental treatments. The control group received placebo lessons which dealt with subject matter unrelated to geometry. The contents of the lessons for each treatment group were:

Group R-A	Recall Instructions, Attribute Instructions, and Geometry Lesson
Group A	Attribute Instructions and Geometry Lesson
Group R	Recall Instructions and Geometry Lesson
Group O-O	Geometry Lesson
Group P	Placebo Lesson

Subjects within a treatment group received the same combination of materials each day with the exception of the first day when no recall instructions were presented.

Substantive content for the geometry lessons was as follows:

Lesson I	simple, closed, polygon
Lesson II	quadrilateral
Lesson III	parallel, trapezoid
Lesson IV	parallelogram
Lesson V	rhombus

Subjects in treatment groups R-A and A received booklets in which written attributes instructions preceded each lesson. A copy of all attribute instructions may be found in Appendix A. Attribute instructions focused the students' attention on the relevant attributes of each concept by providing leading questions called clues. All clues were briefly introduced in Lesson I. They were repeated and expanded in the instructions for the lessons to which they were relevant. The five clues were as follows: (1) Is the figure simple? (2) Is the figure closed? (3) How many sides does the figure have? (4) How many pairs of parallel sides does the figure have? (5) How many sides are of equal length? In Lessons II through V a figure was presented and subjects were instructed to answer the above questions concerning the figure.

Subjects in treatment groups R-A and R received recall instructions prior to each lesson except Lesson I. A copy of all recall instructions may be found in Appendix A. Recall instructions provided for recall of the previously learned concept which was a subconcept for the new concept to be presented. The instructions sought to reinstate the formerly learned concept by asking students to recall the name of the concept, to recall the relevant attributes of the concept, to recall the definition of the concept, and to recognize a positive example of the concept. The concepts recalled in these instructions were as follows:

Lesson II	simple, closed, polygon
Lesson III	quadrilateral
Lesson IV	parallel, trapezoid
Lesson V	parallelogram

Tests

A multiple-choice test was used to test for initial acquisition and for retention of the concepts. This test, a revision of a test used by Scott (1970), was a 35-item multiple-choice test administered to Ss in all treatment groups and in the control group. Two of the items required the recognition of the meanings of mediators given to aid in the recall of concept names (e.g., "quad" means four). These mediators had been provided for the Ss in the geometry lessons. Five items required the recognition of

new geometric shapes given the relevant attributes. These items were intended to measure transfer of learning. The remaining 28 items directly measured concept mastery. This portion of the test was comprised of five of the types of items suggested by Frayer, Fredrick, and Klausmeier (1969) for the measurement of concept mastery: type 1 required recognition of an example of an attribute, given the attribute name; type 3 required recognition of a concept example, given the concept name; type 4 required recognition of a concept non-example, given the concept name; type 6 required recognition of the relevant attribute, given the concept name; and type 9 required recognition of the concept definition, given the concept name. For each concept, there was one item each of types 1, 6, and 9 and two items each of types 3 and 4.

Procedure

The schedule for the study was as follows: Days 1-4, administration of Lessons I-IV; Day 5, administration of Lesson V followed immediately by the multiple-choice test; Day 23, administration of the same multiple-choice test.

The experimenter was a female graduate student who was familiar with the procedures and materials prior to the study. On the first day of the experiment, the children were given general directions concerning the purpose of the study and procedures to be followed in completing the lessons. A copy of these instructions comprises Appendix B. Children were reminded of the essential points of these instructions on Days 2, 3, 4, and 5.

Prior to the beginning of each lesson, new vocabulary was reviewed. A numbered vocabulary list was included in each lesson booklet. The experimenter read aloud each word on the list and had the children repeat it after her. The number of each word was then read in random order and the children were asked to raise their hands when they knew the word which corresponded to that number. One child was asked to say the word. This procedure continued until the experimenter was reasonably assured that all children could recognize and say each word on the list.

While the children studied the lessons, the experimenter proctored to be sure directions were followed. No assistance was offered to the children other than to fulfill requests for pronunciation of words (no such requests were made) or for clarification of procedure.

Experimental Design

The basic design was a 2 x 2 factorial, with two levels of instructions concerning attributes (presence or absence) and two levels of instructions to recall previously learned subconcepts (presence or absence). In addition, there was a control group which received neither the instructions nor the geometry lessons. Thus, there were five treatment groups: four groups which received geometry lessons and some combination of instructions, and a control group which received placebo lessons and no instructions.

Class was included as a blocking factor. Subjects were randomly assigned within each class to one of the five treatment groups. The design is illustrated in Table 1.

Table 1

Experimental Design of the Study

Geometry Lessons				Placebo Lessons
Attribute Instructions		No Attribute Instructions		No Attribute Instructions
Recall Instructions	No Recall Instructions	Recall Instructions	No Recall Instructions	No Recall Instructions
S_1				
.				
.				
.				
S_n				

Comparisons were made to determine the effects of attribute instructions vs. no attribute instructions, recall instructions vs. no recall instructions, the interaction between attribute instructions and recall instructions, and geometry lessons vs. placebo lessons. These comparisons are shown in Table 2.

Table 2

Comparisons Between Treatment Groups

Effect	Treatment Group				
	R-A	A	R	O-O	P
Attribute Instructions	+1	+1	-1	-1	0
Recall Instructions	+1	-1	+1	-1	0
Recall X Attribute	+1	-1	-1	+1	0
Lessons	+1	+1	+1	+1	-4

Two measures were employed to determine the effect of the independent variables on immediate learning and on transfer. These measures were the scores for two subsets of items from the test administered immediately after completion of the lessons. The subsets of items were: (1) specific--the 28 items which tested subject matter specifically taught in the geometry lessons; and (2) transfer--the 5 items which tested transfer of learning to new problems.

Two additional measures were obtained to determine the effect of the independent variables on retention and delayed transfer. These were the scores for specific and for transfer items on the test given 18 days after completion of the lessons.

Analyses of covariance were carried out on each of the four dependent measures. The score on the Reading test of the Metropolitan Achievement Test Battery (Bixler, Durost, Hildreth, Lund, & Wrightstone, 1959) was used as a covariate in order to reduce variability in scores due to differences in reading comprehension ability. A correlation of .35 between reading ability and performance on the type of concept learning test employed in this study has been previously noted by Frayer (1970).

Chapter IV

RESULTS

Four scores were recorded for each subject: (1) specific immediate (SI)--the score for the 28 specific items on the test given immediately after completion of the lessons; (2) specific retention (SR)--the score for the 28 specific items on the test given 18 days after completion of the lessons; (3) transfer immediate (TI)--the score for the 5 transfer items on the test given immediately after completion of the lessons; and (4) transfer retention (TR)--the score for the 5 transfer items on the test given 18 days after completion of the lessons. The two test items which dealt with recognition of mediators were omitted from the analysis. Since all geometry lessons contained the same information concerning the mediators, these items were not expected to differentiate between treatment groups. Descriptive statistics for the mediator items will be presented later in the chapter.

In addition, the score for each student on the Reading test of the Metropolitan Achievement Test Battery (Bixler, Durost, Hildreth, Lund & Wrightstone, 1959) was obtained from school records for use as a covariate.

Tests were analyzed by the FORTRAN Test Analysis Package (Baker & Martin, 1968). The means, standard deviations, ranges, standard

errors of measurement, and Hoyt internal consistency reliabilities (Hoyt, 1941) for SI, SR, TI, and TR are presented in Table 3. It may be noted that the means for each test were above chance but were not so high as to suggest a ceiling effect. The reliabilities were .85 for SI and .87 for SR. These reliabilities are sufficiently high to permit detection of differences between groups. The reliabilities for the transfer tests were lower, .41 for TI and .48 for TR, probably due to the fact that these tests were comprised of qnly five items.

Analyses of Covariance

Four univariate analyses of covariance were performed using Finn's (1968) Multivariance computer program. Dependent variables were scores for the specific immediate test (SI), specific retention test (SR), transfer immediate test (TI), and transfer retention test (TR). Means and standard deviations of observed test scores for each treatment group are presented in Table 4.

The covariate was the grade equivalent score on the Reading test of the Metropolitan Test battery, a test designed to measure various aspects of reading comprehension. This score was selected as a covariate in order to reduce variability due to differences in reading comprehension ability. Table 5 contains the adjusted mean scores on the specific immediate, specific retention, transfer immediate, and transfer retention tests by treatment group and the observed mean scores on the reading covariate. It is interesting to note that the group which received the geometry lessons but no

Table 3

Reliability Estimates for Immediate and Retention Specific Tests and Immediate and Retention Transfer Tests

Test	Number of Items	Mean Score	Standard Deviation	Range of Scores	Standard Error of Measurement	Hoyt Reliability
Specific Immediate (SI)	28	19.12	5.54	7-28	2.10	.85
Specific Retention (SR)	28	17.60	6.05	7-28	2.16	.87
Transfer Immediate (TI)	5	3.42	1.22	0-5	.84	.41
Transfer Retention (TR)	5	3.36	1.30	0-5	.84	.48

Table 4

Means and Standard Deviations of Immediate and Retention Specific Test Scores and Immediate and Retention Transfer Test Scores by Treatment Group

Test	Recall and Attribute Instructions	Attribute Instructions	Recall Instructions	Geometry Lesson Only	Placebo Lesson
Specific Immediate (SI)	19.04 (5.87) N=23	20.95 (5.27) N=21	19.56 (4.91) N=18	21.26 (4.98) N=19	15.05 (4.58) N=21
Specific Retention (SR)	17.74 (6.71) N=23	18.33 (5.63) N=21	17.67 (6.49) N=18	18.95 (5.73) N=19	15.43 (5.59) N=21
Transfer Immediate (TI)	3.22 (1.20) N=23	3.33 (1.53) N=21	3.17 (1.20) N=18	4.05 (.91) N=19	3.38 (1.07) N=21
Transfer Retention (TR)	3.04 (1.43) N=23	3.10 (1.37) N=21	3.33 (1.14) N=18	4.05 (1.03) N=19	3.38 (1.28) N=21

Note.- Standard deviations are given in parentheses.

Table 5

Adjusted Mean Scores on SI, SR, TI, and TR Tests by Treatment Group and Mean Grade Equivalent Scores on Metropolitan Reading Test

Test	Recall and Attribute Instructions	Attribute Instructions	Recall Instructions	Geometry Lesson Only	Placebo Lesson
Specific Immediate (SI)	19.56	22.06	19.47	19.56	15.00
Specific Retention (SR)	17.88	19.52	17.49	17.32	15.46
Transfer Immediate (TI)	3.27	3.45	3.17	3.78	3.35
Transfer Retention (TR)	2.94	3.37	3.25	3.84	3.35
Metropolitan Reading Test[a]	7.63	7.53	7.80	8.75	7.96

[a]Scores on Metropolitan Reading Test are grade equivalents.

instructions had a much higher covariate mean score than the other groups had. This undoubtedly contributed to the higher scores attained by this group and may have invalidated the experiment inasmuch as the higher mean reading score may reflect higher motivation and other characteristics of the group that are associated with higher achievement.

A univariate regression analysis was carried out to analyze the relationship of the covariate to the dependent variables. Table 6 contains the univariate statistics summarizing the regression analysis. The univariate F's indicate that a significant amount of each dependent variable's variance can be predicted by the covariate. Since r^2 equals the percent of variance predicted, we can see that the amount of variance accounted for by the reading score is 33% for SI, 19% for SR, 24% for TI, and 15% for TR.

Since the number of subjects in the cells varied slightly, the analysis of covariance design is non-orthogonal. Because of this, the effects are not independent and are tested in step-wise fashion. The effects of greatest interest are ordered last to obtain unbiased tests of them. Test of effects were carried out in the indicated order. The significance level adopted in this experiment was .05.

Results of the analyses of covariance on the immediate and retention specific test scores are presented in Table 7. There were no significant effects due to class or to the interaction between class and treatment.

Table 6

Regression Analysis of the Relationship between the Dependent Variables and the Reading Covariate

Variable	r	r^2	F	Probability
SI	.5726	.3279	37.0746	< .0001
SR	.4343	.1886	17.6699	< .0001
TI	.4930	.2430	24.4024	< .0001
TR	.3901	.1522	13.6408	< .0005

Degrees of Freedom for Hypothesis = 1

Degrees of Freedom for Error = 76

Table 7

Analyses of Covariance of Immediate and Retention Specific Test Scores

	Specific Immediate			Specific Retention		
Source	F	df	Probability	F	df	Probability
Class	.2194	4/76	< .9269	.5315	4/76	< .7130
Class X Treatment	.8165	16/76	< .6632	.5720	16/76	< .8954
Lessons (L)	26.3869	1/76	< .0001*	3.9804	1/76	< .0497*
Recall Instructions (R)	1.9697	1/76	< .1646	.3673	1/76	< .5463
Attribute Instructions (A)	1.7167	1/76	< .1941	1.0214	1/76	< .3154
Recall X Attribute (R X A)	1.5688	1/76	< .2143	.5131	1/76	< .4761

* Significant at the .05 level.

The effect of lessons was significant. The univariate F's for both the immediate and retention test scores have probabilities less than .05.

The effect due to recall instructions was not significant on the immediate or retention test.

The effects of attribute instructions and of the interaction between recall instructions and attribute instructions were not significant.

Results of the analyses of covariance on the immediate and retention transfer test scores are summarized in Table 8. The only significant effect was that due to recall instructions on the retention test. Inspection of the adjusted mean scores presented in Table 5 indicates that the subjects who did not receive recall instructions performed better than subjects who received such instructions.

Mediator Items

Two test items dealt with recognition of mediators given in the geometry lessons to aid in recall of concept names. Percent correct responses on the mediator items for treatment and control groups on the immediate and retention tests are given in Table 9. One item, which asked "What does quad mean?", did not discriminate between Ss receiving the lessons and Ss not receiving the lessons. The other item, "Trapezoid comes from the Greek word which means:", was more discriminating. Subjects receiving the lessons had 41% (immediate

Table 8

Analyses of Covariance of Immediate and Retention Transfer Test Scores

	Transfer Immediate			Transfer Retention		
Source	F	df	Probability	F	df	Probability
Class	.2894	4/76	< .8841	.8148	4/76	< .5197
Class X Treatment	.9504	16/76	< .5177	1.4649	16/76	< .1358
Lessons (L)	.0570	1/76	< .8119	.0109	1/76	< .9172
Recall Instructions (R)	2.3305	1/76	< .1311	4.0692	1/76	< .0473*
Attribute Instructions (A)	.1841	1/76	< .6691	2.2248	1/76	< .1400
Recall X Attribute (R X A)	.7250	1/76	< .3972	.0893	1/76	< .7660

* Significant at the .05 level.

test) and 53% (retention test) correct responses on the item while Ss not receiving the lessons had 14% (immediate test) and 19% (retention test) correct responses.

Table 9

Percent of Correct Responses on the Mediator Items of Immediate and Retention Tests by Treatment and Control Groups

Mediator	Test	Treatment Groups	Control Group
Quad	Immediate	85%	71%
	Retention	89%	85%
Trapezoid	Immediate	41%	14%
	Retention	43%	19%

To determine the relationship between knowledge of the mediator and mastery of the concept, performance on 6 of the trapezoid items was compared for subjects responding correctly and incorrectly on the mediator item. The mean score on these trapezoid items for the 37 subjects correctly identifying the mediator was 3.84, for the 65 subjects incorrectly identifying the mediator, 2.54.

Lesson Statistics

The lessons were intended to be a learning exercise and were, therefore, read but not scored. The lessons varied only slightly in length according to treatment. No time requirements were imposed on

the Ss. It is interesting to note, however, the average length of time and the range of times spent in study by each treatment group (Table 10). In interpreting the data one should realize there was some unreliability in the self-reports of time elapsed due to errors in telling and recording time. The differences are not great. However, Ss receiving the recall instructions, attribute instructions, and a combination of the two instructions did spend more time (an average of 62.4, 57.6, and 61.5 minutes, respectively) completing the lessons than Ss receiving only the geometry lessons (55.6 minutes). Possibly the geometry lesson only group read more rapidly since they had higher reading scores. In other words, the lesser amount of time may have been related to their superior reading achievement as well as to not having to read the instructions.

Table 10

Mean Completion Times and Ranges of Times for Each Lesson and Total Completion Times and Ranges of Times (in minutes) by Treatment Group

Treatment Group	Lesson I	Lesson II	Lesson III	Lesson IV	Lesson V	Total for All Lessons
Geometry Lesson Only	12.36 (7-20)	8.86 (5-16)	13.48 (8-23)	9.32 (5-15)	11.60 (6-21)	55.61 (31-95)
Recall Instructions	12.00 (4-17)	11.82 (6-21)	14.79 (8-25)	10.83 (6-16)	12.91 (6-25)	62.36 (30-104)
Attribute Instructions	14.32 (8-22)	9.57 (3-15)	13.70 (7-19)	9.72 (5-13)	10.30 (5-18)	57.60 (28-87)
Recall and Attribute Instructions	12.33 (6-18)	11.48 (6-18)	14.29 (6-22)	10.91 (6-17)	12.46 (7-19)	61.45 (31-94)
Placebo Lesson	13.17 (9-17)	12.46 (8-18)	14.27 (8-19)	12.12 (7-20)	14.08 (9-22)	66.09 (41-96)

Note.- Ranges in times are in parentheses.

Chapter V

DISCUSSION AND SUMMARY

The major objective of this study was to determine the effects of two instructional variables, recall of relevant subconcepts and information regarding the attributes of the concept instances, on immediate concept learning, transfer, and retention.

Five groups of children were drawn randomly from the same sixth-grade child population. Despite the random drawing, one group that did not receive instructions but did receive geometry lessons had a much higher mean reading achievement (equivalent to a grade level of 8.75) than did the three groups that received the instructions (grade equivalents of 7.63, 7.53, and 7.80). The level of reading achievement did correlate positively with the students' performances on the dependent measures used in this study. The group having the highest reading achievement consistently scored higher than any other group. Although analysis of covariance was used in the analysis, the results of the experiment must be considered tentative in that the group that received the geometry lessons only was greatly different in reading achievement from the remainder of the child population.

Recall Instructions

The analysis of covariance indicated that recall of relevant subconcepts did not have a significant effect on the specific immediate

test, on the specific retention test, and on the transfer immediate test. There was a significant effect on the delayed transfer test. The adjusted mean scores for the groups receiving the recall instructions were significantly lower than the adjusted mean scores for the groups not receiving the recall instructions.

The instructions attempted to reinstate the previously learned concept which was a relevant subconcept for the new concept to be presented. In the recall instructions, questions were asked about previously learned concepts, and feedback was provided for each question. However, inspection of answers to questions suggested that some students did not utilize the feedback effectively. For instance, students gave answers which were not synonymous with the correct answers (e.g., "shape" instead of "polygon"), but did not change them after receiving feedback. In some cases, then students in the recall condition may have practiced incorrect responses.

In conclusion, recall instructions were not facilitative. This may have been due to practice of incorrect responses during recall. In order to correct these misconceptions individualized feedback would be needed (Klausmeier & Goodwin, 1966). Blount, Klausmeier, Johnson, Fredrick, and Ramsay (1967) found feedback to have a significant effect on student's performance on English syntax tests. The feedback included information from the corrected tests of the previous lesson, the positive comments written on the tests, and the discussion held once the tests were in the hands of the students.

Another experiment should be carried out before firm conclusions are drawn regarding the effect of recall instructions. In the replication the treatment might be strengthened by returning the previous day's lesson with corrections noted. This would provide individualized

feedback regarding individual misconceptions as well as more comprehensive review of the relevant subconcepts.

Attribute Instructions

Instructions acquainting the students with the attributes of the concept instances had no significant effect on the specific immediate learning or specific retention. This lack of effect might be due to the nature of the geometry lessons which all students except those in the control group received. The lessons pointed out the relevant attributes of each concept as well as presenting examples and a definition. While the lessons presented this information in a slightly different manner than did the attribute instructions, this information was none the less repetitive.

One should note that in laboratory studies this repetition of information does not usually occur, since subjects are presented the concept visually with no verbal description. Therefore, one would expect a greater effect in the laboratory situation. However, firm conclusions should be withheld until this experiment is replicated.

Geometry Lessons

Providing Ss with lessons dealing with the geometric concepts had a significant effect on both immediate concept mastery and retention. The weaker effect of lessons on the retention test than on the immediate test might have been due to learning on the part of the control group during the previous exposure to the test. As may be noted from Table 5, the mean scores for each treatment group decreased on the retention test while the mean score for the control

group increased on the retention test over the immediate test. Ss had not been screened for previous study of quadrilaterals. Four of the five classes had studied quadrilaterals sometime during the current school term. (Stephens, 1956, has discussed the use of tests as a means of recall or review).

Study of geometry had no significant effect on transfer. In interpreting the lack of a transfer effect, it should be noted the five transfer items dealt with new geometric shapes and asked such questions as "Which figure is 4-sided, not closed, and has all sides of equal length?". Since most Ss had had prior learning experiences with geometric shapes, it is not surprising that the lessons did not have a significant effect on the transfer tests, immediate or retention.

Reading and Concept Mastery

A high correlation between reading ability and concept mastery was noted. Of particular interest is the fact that even though an attempt was made to limit the vocabulary to the third grade level with the exception of the concept names, the S's ability to comprehend information from printed material with a controlled vocabulary was correlated with his performance on the test of concept mastery.

Summary

Ss studied one lesson each day for five days. After studying the lessons, on the fifth day children were given a 35-item multiple-choice test consisting of 28 items dealing with the concepts themselves, 5 transfer items, and 2 mediator items. This same test was administered 18 days later to test for retention.

Reading comprehension scores were used as a covariate to reduce variance in concept learning scores due to this factor.

The essential findings of the study were:

(1) Providing recall of relevant subconcepts did not have a significant effect on immediate concept mastery or on retention.

(2) Providing recall of relevant subconcepts did not have a significant effect on immediate transfer but did on delayed transfer.

(3) Acquainting Ss with the attributes of the concept examples did not significantly affect immediate concept mastery or retention.

(4) Acquainting Ss with the attributes of the concept examples did not significantly affect immediate transfer or delayed transfer.

(5) Providing lessons dealing with the geometric concepts significantly increased immediate concept mastery and retention.

(6) Providing lessons dealing with the geometric concepts did not significantly increase immediate transfer, but did significantly increase delayed transfer.

Suggestions

These findings indicate the need for replicating the experiment. In the replication the following changes should be made.

(1) An alternate form of the geometry test should be given for the retention test to eliminate the possible learning acquired during the initial encounter with the test.

(2) The previous day's lessons should be corrected and returned to students as part of the recall treatment as a means of individualized feedback and more comprehensive recall of the relevant subconcepts.

(3) Reading comprehension or some measure of mathematics achievement should be used as a stratifying variable in order that any interaction between the level of achievement and the treatments might be detected. Similarly sex should be used as a stratifying variable.

APPENDIX A

Attribute Instructions and Recall Instructions

Lesson I: Attribute Instructions

You have been chosen to become M.A.T.H. agents. As agents you will learn to find different kinds of geometric figures. A chief will be in charge of your training. He is waiting for you in his office. Let's join him now while he is explaining just what you will be doing as M.A.T.H. agents.

"You are probably wondering what these lessons are going to be about," the chief began. "When you were younger, you learned to tell the difference between a circle and a triangle. Now you are ready to learn the differences and likenesses between other geometric figures by learning the special parts of each figure. The parts you want to look at are the number of sides, the length of each side, and the number of parallel sides. You will also want to see if each figure is closed and if it is a simple figure.

"We call this looking for clues. You will learn five clues. Your job as agents is to use these clues to learn how the figures are alike and how they are different. Here are the five clues that will help you find the important parts of each figure:

1. Is the figure simple?
2. Is the figure closed?
3. How many sides does the figure have?
4. How many pairs of parallel sides does the figure have?
5. How many sides are of equal length?

"Pam and Joe are going to work with you. I think you will find that they are useful friends as you look for clues.

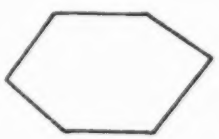
"Good luck, agents," said the chief.

Lesson II: Attribute Instructions

Somewhat later the agents met again in the chief's office. Yesterday you learned what polygons are," began the chief. "Before you go out on your first job I want you to think about this new clue---how many sides the figure has. Now let's look at the three clues we have learned so far:

1. Is the figure closed?
2. Is the figure simple?
3. How many sides does the figure have?

"These clues tell you what parts of the figure are special and important. These important parts tell you if the figure is the one you are looking for. Let's look at this figure. Use the clues to find out about its important parts. (Write the correct answer.)



1. Is the figure closed?_____
2. Is the figure simple?_____
3. How many sides does the figure have?_____

"Don't hurry when you are looking for a new figure. Each clue is important. Remember the new clue---how many sides the figure has."

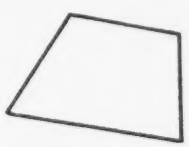
Lesson III: Attribute Instructions

"You agents are great at using clues," said the chief. "Today you will learn a new clue---how many pairs of parallel sides the figure has. We will talk about how the sides of a figure look if they are parallel."

"You will also want to use the clues we talked about before. These clues help you see what parts of a figure are important and make one figure different from other ones. Let's read the list of clues we have learned.

1. Is the figure simple?
2. Is the figure closed?
3. How many sides does the figure have?
4. How many pairs of parallel sides does the figure have?

"Now look at this figure and answer the questions."



1. Is the figure simple?_____
2. Is the figure closed?_____
3. How many sides does the figure have?_____
4. How many pairs of parallel sides does the figure have? (Later you will find out how to tell if the sides are parallel.)

"Think about these clues while you wait for your next job," said the chief.

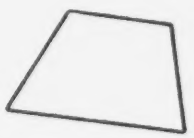
Lesson IV: Attribute Instructions

"There is no new clue for today," began the chief. "You can find the new figure by using the clues that you have already learned.

"Now let's read the list of all the clues.

1. Is the figure simple?
2. Is the figure closed?
3. How many sides does the figure have?
4. How many pairs of parallel sides does the figure have?

Look at this figure. It is one of the figures you saw yesterday, but now you can answer all four questions about it.



1. Is the figure simple?_____
2. Is the figure closed?_____
3. How many sides does the figure have?_____
4. How many pairs of parallel sides does the figure have?_____

"Again, let me remind you not to skip any clues," the chief said. "No clue is too small or unimportant. The good agent uses each one.

"Now you are ready for your next job. Remember, use all four of the clues when looking for the figure. I'll call you when the next job is ready."

Lesson V: Attribute Instructions

Soon the agents met with the chief for another lesson on clues. "You will be looking for a new figure soon. The new clue is---the number of sides of equal length. Remember to use all of the clues that you have already learned carefully. Good agents use clues well, even though they seem small and unimportant," the chief said.

"Again let's read over the five clues we have learned.

1. Is the figure simple?
2. Is the figure closed?
3. How many sides does the figure have?
4. How many pairs of parallel sides does the figure have?
5. How many sides are of equal length?

Now look at this figure and answer the questions about it.

1. Is the figure simple?_____
2. Is the figure closed?_____
3. How many sides does the figure have?_____
4. How many pairs of parallel sides does the figure have?_____
5. How many sides are of equal length?_____

"You are using the clues very well, agents. Be sure to remember the new clue---the number of sides of equal length," the chief said. "I'll let you know when I need you."

Lesson II: Recall Instructions

The M.A.T.H. agents met for a review meeting with the chief. He began, "What is the name of the figure you found yesterday?"

"It is _____," Joe answered.

"Good," said the chief. "How do you know if a figure is a polygon?"

"First of all," said Pam, "a polygon is a _____figure."

"And it is a _____ figure," added Joe.

"YOU said, "The figure is made up of sides that _____

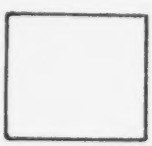
_____."

"Right," said the chief. "A polygon is a simple, closed figure made up of sides that are all straight lines. Now look at this figure. Is it a simple figure? (Check ✓ the right answer.)

simple____

not simple____

The chief went on, "You are right. The figure is simple. Now look at this figure. Is it closed?" (Check ✓ the right answer.)



closed____

not closed____

"You are right again," said the chief. "The figure is closed. Now look at another figure. Is this figure a polygon?" (Check ✓ yes or no.)

yes____

no____

"I'm glad you said yes. Remember, a polygon is a simple, closed figure made up of sides that are all straight lines."

Lesson III: Recall Instructions

The chief called the agents together. "I like the way you are finding geometric figures. Now do you remember the name of the figure you found yesterday?" he asked.

"The name of the figure is _____," said Joe.

"What is a quadrilateral?" the chief went on.

"It is a _____," answered Joe.

"But what makes a polygon a quadrilateral?" asked the chief.

"The important thing to remember is that a quadrilateral always has_____," YOU added.

"Very good," said the chief. "You are right. A quadrilateral is a polygon that has four sides and only four sides."

"Look at this figure. Is it a quadrilateral?" asked the chief. (Check ✓ yes or no.)

yes_____

no_____

"You are right, the answer is yes," said the chief. "It is a quadrilateral. You have learned your lesson well."

Lesson IV: Recall Instructions

The agents were busy talking with the chief.

"What was the name of that figure we found yesterday?" asked Pam.

"It is called a _____," answered Joe.

"What is a trapezoid?" asked the chief. "Do you remember?"

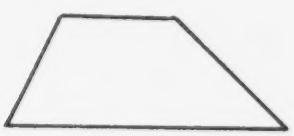
"I remember," YOU said. "A trapezoid is a _____ that has _____."

"Agents, you remember very well," said the chief. "A trapezoid is a quadrilateral that has one pair and only one pair of parallel sides. But, do you remember what parallel sides are? Look at this pair of lines. Do they look parallel? (Check ✓ yes or no.)

yes_____

no_____

"I'm glad you checked yes because they are parallel lines. Now look at this figure. Is it a trapezoid?" asked the chief. (Check ✓ yes or no.)



yes_____

no_____

"You are right, the answer is yes. The figure is a trapezoid. Good work, agents. I'll see you later."

Lesson V: Recall Instructions

"We have had fun looking for different geometric figures and learning the names of them," the chief said. "Does anyone remember the name of the figure you met yesterday?"

"The name of the figure is_____," answered Joe.

"Good," said the chief. "Now what do I need to remember if I want to be able to pick out a parallelogram?" he asked.

"A parallelogram is a_____

_____," YOU answered.

"Very good," said the chief. "A parallelogram is a quadrilateral with two pairs of parallel sides. What do we know about the length of of the sides?"

Pam answered, "_____

_____."

"Yes, the opposite sides of a parallelogram measure the same length," the chief said. "Look and see if this figure is a parallelogram." (Check ✓ yes or no.)

yes_____

no_____

"Right, again. The answer is yes. The figure is a parallelogram. We will meet together soon and talk about another figure for you to find. Good-bye," said the chief.

APPENDIX B

General Instructions for the Lessons

General Instructions for the Lessons

Hi-- I'm _____

I'm not sure just what you have been told about why I am here. So I'll try to explain it a little. I am working with some Educational Psychologists at the University of Wisconsin in Madison. These psychologists are trying to find ways for making it easier for students to learn mathematics. They have written some lessons for you to study. Each day this week you will be given one of them. At the end of the week after you have completed Lesson V, you will be given a test to see how much you have learned. Please do the best job you can on both the lessons and the tests. Since we are trying out different ideas, the booklets are not the same. There are five different kinds, each one as important as the other.

Before you begin this series of five lessons, let's talk about what you will be doing. If you have any questions ask them right away. After you begin the lesson I will only answer questions about words you do not know and directions you do not understand.

The word YOU (write on board) is used in some of the lessons. That YOU means you, the reader. When the lesson asks YOU a question, you (point) answer in your booklet.

You will find empty blanks on which you should write the correct answer. If you remember--I mentioned earlier that all of the booklets are not the same. In some of them you will find the correct

answer underlined as you read on. For example: Mary and John were talking about how people look. (Write the following on the board.) Mary said, "People have two arms, two hands, and _____ fingers." John said, "That's right. People not only have ten fingers, they also have ten toes."

If you wrote nine instead of ten in the blank, (do so) then after reading the correct answer, ten, you should go back and cross out the nine (do it) and write in the ten above (do it). By not erasing we can tell which questions were either too hard or not clear.

Other times you might be asked to pick out certain figures and check (✓ on board) them. Sometimes you will find the correct answers as you read on. Again, look at your answer and correct it if needed.

If you are asked to draw certain figures, draw each one carefully.

Do you have any questions so far?

Okay--here is Lesson I (hand out). Please do not open your booklet until I say to do so.

Some of you will need rulers so each one of you take a ruler just in case you need one. (Hand out rulers.)

Now does everyone have a Lesson I and a ruler? Does everyone have a pencil he can use?

Good--now look at the name written on the booklet. Make sure it is your name. Also look to see if the name of the school is correct. Under the grade and date do you see where it says "Starting Time" and "Finishing Time"? Later, you will write the time you start on the line

that says "Starting Time" and the time you finish on the last line. This is not a race to see who gets done first. The important thing is for you to learn the material presented. But we would like an idea on how long it takes sixth-grade children to do these lessons.

When you have finished turn the booklet over and write any comments you may have. If you did not understand the lesson--tell us. If you thought it was boring or dumb--tell us. If you can, write how you would improve the lessons. If you liked the lessons, understood the material presented, or found them interesting--tell us that, too. You are very important because you have the opportunity to speak for sixth graders. And your comments will be read as well as your answers on the lessons and tests. If you write any comments on the back of the lesson do so after you have recorded your finishing time.

When you are finished please read, do a class assignment, or whatever. Just stay in your desk and do it quietly.

If you don't know a word--raise your hand and I will come help you. We did pick out a list of words that might be new. Turn the page of your booklet. Do you see the word list? (Read the heading, pronounce each word and have children repeat it. Ask if they can pronounce each word--any questions.)

Okay--now turn back to the cover page. Write the exact time it is now (tell them) where it says "Starting Time". When you finish write the exact time where it says "Finishing Time". Don't hurry. Work carefully. You may begin.

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